Percutaneous Transluminal Angioplasty and Stenting for Chronic Total Occlusion of Intracranial Carotid Artery

A Case Report

H. ISHIHARA, N. SAKAI, T. KUROIWA, M. SAKAGUCHI, A. MORIZANE, C. SAKAI
T. YANO, R. KAJIKAWA, H. YAMAGAMI, J. KOBAYASHI

Department of Neurosurgery and Neurology, Kobe City General Hospital
4-6, Minatojima-Nakamachi, Chuo-ku, Kobe, 650-0046, Japan

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Summary

Chronic total occlusion of cerebrovascular lesions is regarded as a contraindication to revascularization. We describe a case of chronic total occlusion of intracranial internal carotid artery that iwass successfully recanalized by endovascular treatment.

A 72-year-old man who presented with slight right hemiparesis was proved to have chronic total occlusion of the left intracranial internal carotid artery. Percutaneous transluminal angioplasty/stenting was achieved using reversal of flow with the Parodi Anti-Embolic System. The present case indicates that percutaneous transluminal angioplasty/stenting can be an effective therapeutic option in selected patients with chronic total occlusion of cerebrovascular lesions.

Introduction

The effectiveness of percutaneous coronary intervention (PCI) of chronic total occlusion (CTO) in coronary lesions is beginning to be established. In cerebrovascular lesions, however, this method has not been applied because of its technical difficulty and the risk of distal embolism that may result in severe neurological deficits. We describe a patient with CTO of the internal carotid artery (ICA) who was successfully treated by PTA/stenting.

Case Report

A 72-year-old man with a history of hypertension developed sudden right hemiparesis and dysarthria, and was admitted to our hospital on 27th July 2004. He had suffered a small cerebral infarction in the left coronal radiation area two years previously, and was diagnosed with right ICA occlusion and left vertebral artery occlusion. He was subsequently followed by the Department of Neurology in our hospital with administration of anti-platelet drugs. A neurological examination at admission revealed only slight right hemiparesis. MRI showed a small cerebral infarction in the right frontal lobe with high intensity in a diffusion-weighted image (figure 1A) and chronic degeneration in the right frontal white matter with high intensity in a FLAIR image, and MRA revealed bilateral ICA occlusion (figure 1B). A cerebral angiography performed seven days after admission revealed left ICA occlusion at the cavernous segment, and antegrade distal ICA filling via the ophthalmic artery (figure 2A,B). With the intention of carrying out angioplasty, cerebral angiography was performed for the second time 30 days after admission, and left common carotid angiography showed an occluded ICA at the cervical segment.

The procedure was performed under local anesthesia. During the endovascular treatment,

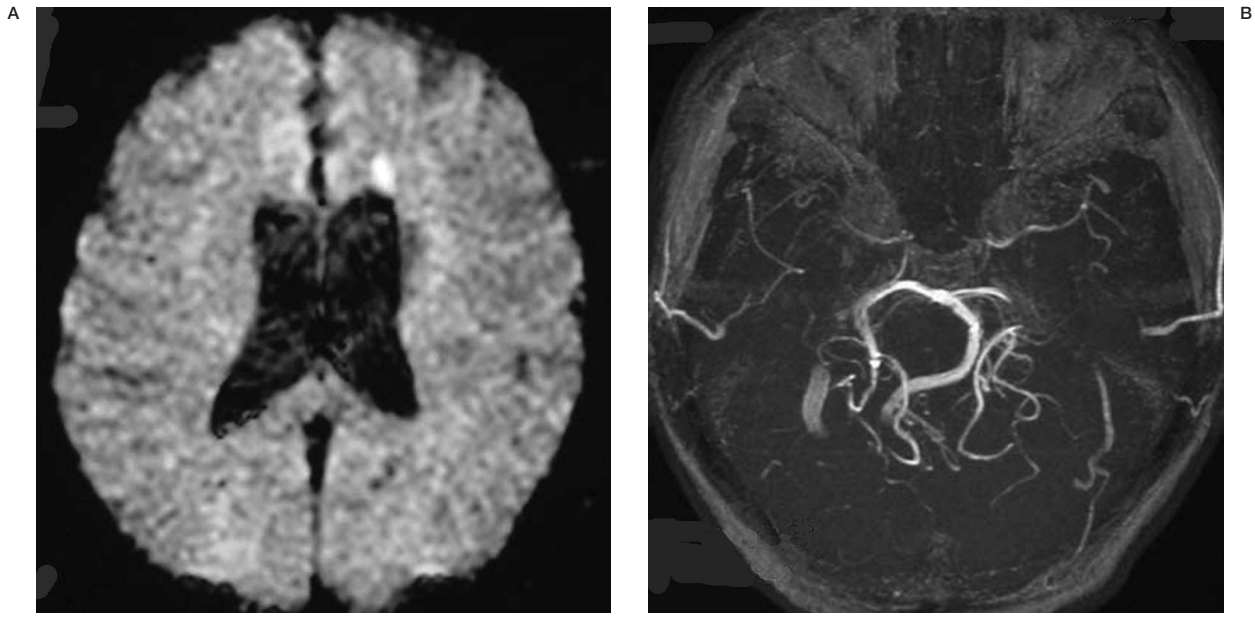

Figure 1 A diffusion-weighted MRI scan (A) shows that diffusion is restricted in the left frontal white matter. MRA (B) revealed bilateral internal carotid artery occlusion.

mean blood pressure was around 110-120 mmHg. An 11 French long sheath introducer was placed in the right femoral artery. Parodi Anti-embolic system (ArteriA, San Francisco, CA, USA) was placed in the distal right common carotid artery and proximal external carotid artery to provide distal embolic protection. The occluded lesion crossing was attempted with a 16-microguidewire (GT microguidewire, Termo) and 18-microcatheter (Transit II, Cordis).

The microguidewire and microcatheter crossed over the lesion without strong resistance, with only the cavernous segment having a slight degree of resistance (figure 3A). At first, the cavernous segment was dilated with an Unryuu balloon catheter (2.0 x 10 mm, 10 atm., Kaneka, Tokyo Japan) and a balloon expandable 3.0 x 15 mm driver (Medtronic Vascular, US) was deployed (figure 3B). Subsequently, the cervical ICA was treated with two 8.0 x 40mm X-part stents (Abbott Vascular, Illinois US) (figure 3C). A control angiogram showed whole recanalization of the ICA with a stenotic lesion in the petrous segment of the ICA. Carotid recanalization with completely restored blood flow was achieved after an additional stent (3.5 x 18 mm, Driver, Medtronic Vascular) was placed in the petrous segment (figure 3D, figure 4A,B). After recanalization of the ICA, anti-thrombin therapy (argatroban 2.5 mg/h) was continued for 48 hours, and blood pressure was strictly controlled to avoid hyperperfusion syndrome.

Control MR imaging after 48 hours showed small perfusion deficits within the left frontal lobe. No new neurological deficits were observed. He had complained of lightheadedness upon standing before treatment, however, this symptom had become milder. Although it is not a precise quantitative appreciation of the cerebral perfusion, single-photon emission computed tomography showed that the laterality of the cerebral blood flow was improved in the left MCA territory (figure 5A,B).

In the examination of cognitive function, the preoperative minimental score was 23/30, and this score improved to 28/30. The patient was discharged ten days after intervention. Administration of anti-platelet drugs was continued. In an up to six-month follow-up period, no cerebral ischemic events were observed, and the patency of the left ICA was confirmed by cerebral angiography.

Discussion

Currently, the endovascular recanalization of occluded IC in chronic stage is not a common treatment. This is mainly due to the technical

Figure 2 Midarterial phase (A) and late arterial phase (B) DSA images in lateral projection show internal carotid artery occlusion at the cavernous segment.

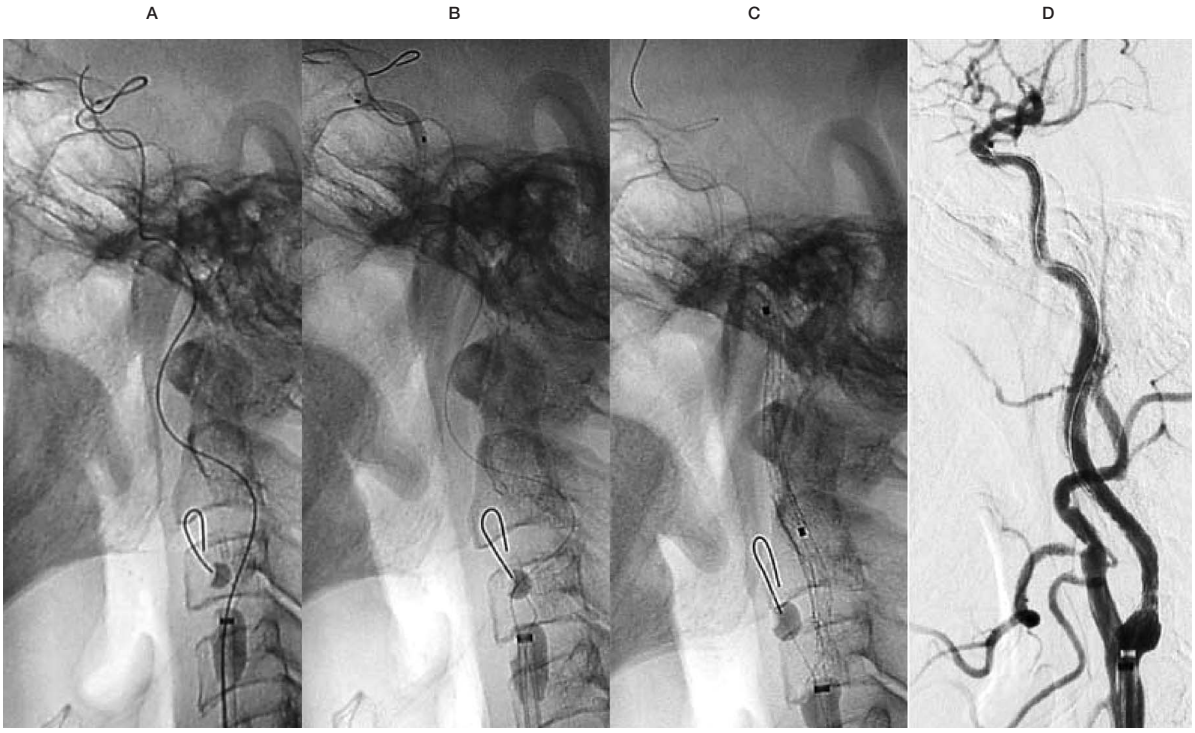

Figure 3 A microcatheter and wire have been advanced through the occlusion with PAES (A). A coronary stent was placed in the cavernous segment of the ICA (B). Two self-expandable stents were deployed to the cervical segment of the ICA (C). After angioplasty and stent deployment, carotid recanalization with completely restored blood flow was achieved (D).

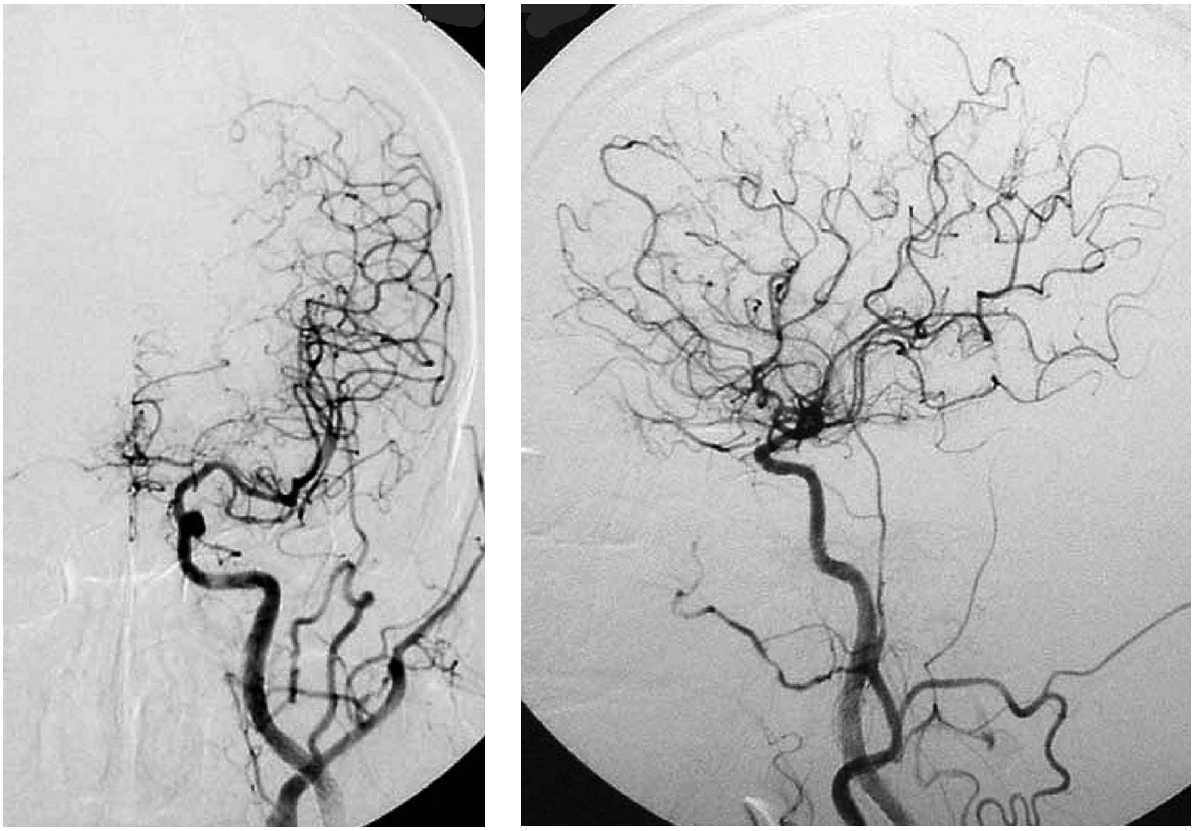

Figure 4 DSA images obtained after angioplasty and stent deployment show carotid recanalization.

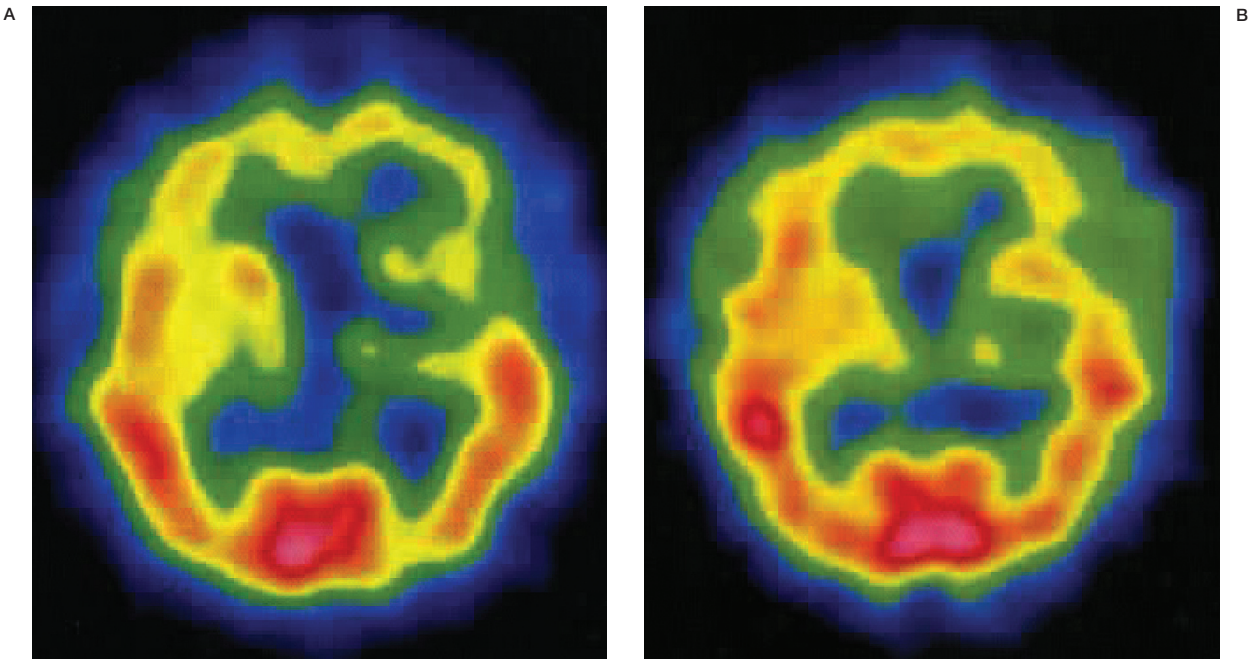

Figure 5 Single-photon emission computed tomography obtained before endovascular treatment (A) and after treatment (B).

difficulty and the risks related to the procedure. There are also suspicions about its effectiveness for revascularization in chronic stage. The collateral circulation may be developed in many cases with the chronic IC occlusion, whereas some cases result in chronic hypoperfusion. In this case, cerebral blood flow was dynamically compromised because of bilateral ICA and left vertebral artery occlusion. This treatment therefore seems effective in improving cerebral hemodynamics, leading to the prevention of cerebral ischemia.

There are few published reports on endovascular recanalization of chronic cerebrovascular occlusion [1]. Terada et al. successfully treated totally occluded ICA of the cervical segment in chronic stage. In the present case, the primary lesion was the ICA of the cavernous segment.

When we adhere to the criterion of chronic total coronary occlusion [2], a chronic total cerebrovascular occlusion is defined as a cerebral artery occlusion with an estimated duration of more than one month. The present case satisfies these conditions.

PTCA of a chronic total coronary occlusion was first reported in the first half of the 1980s [3,4]. The primary success rate is relatively low, while the recurrence rate is higher than that of subtotal stenosis [5,6]. However, the availability of new specialized guidewires or more sophisticated technologies for crossing occluded arteries has improved the immediate success rate. In addition, randomized studies have demonstrated that stent implantation reduces restenosis and reocclusion rates [7,8] Because some retrospective studies suggest that successful PCI of a CTO confers a long-term survival advantage, PCI for CTO has gained the broad consensus [9,10] On the other hand, PTA of a CTO has not been applied in cerebrovascular lesions because of catastrophic complications due to distal embolism.

Angioplasty/stenting for CTO is technically very intricate because distal protection devices are unable to be applied to this situation. Among the embolic protection devices, the ArteriA Parodi Anti-embolic system (ArteriA, San Francisco, CA, USA) [11] is required to avoid distal embolism. This cerebral protection system relies on retrograde flow during intervention. An occluding guiding catheter in the CCA and an occluding balloon in the external carotid artery (ECA) create reverse arterial flow from the targeted ICA, into the guide catheter, and in turn into the femoral vein through a dual sheath system. At the moment, it is considered that this system is the only one to allow PTA for IC occlusion.

In coronary intervention, several groups have emphasized the CTO duration and length as important predictors of crossing success [9,12]. Because the pathology of cerebrovascular occlusive lesions is based on atherosclerosis in the same way as in coronary lesions, these predictors seem to be applicable to cerebrovascular lesions.

Postoperative management demands meticulous attention to the avoidance of hyperperfusion syndrome. In the present case, a patient with multiple occlusion of the cerebral artery required angioplasty. However, it has been reported that such patients with severe bilateral carotid stenosis and arterial hypertension are predisposed to hyperperfusion syndrome [13]. In our hospital, transcranial doppler (TCD) is performed to evaluate the blood-flow velocity of MCA intraoperatively and daily after intervention. TCD provides a large amount of information regarding cerebral hemodynamics in real time. Several studies have demonstrated the usefulness of TCD to detect hyperperfusion syndrome, and the diagnostic criterion is mostly a ≥ twofold increase in the MCA mean flow velocity after revascularization of the internal carotid artery [14,15]. Due to defective autoregulation in brain regions with preexisting chronic misery perfusion, revascularization may lead to a marked increase in ipsilateral CBF dependent on blood pressure. Therefore, strict control of blood pressure is considered to be vitally important.

Although further accumulation of clinical data is required to identify the indications and to prove the effectiveness of PTA/stenting, it appears that this method may be an effective therapeutic option in selected patients with CTO of cerebrovascular lesions.

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Hideyuki Ishihara, M.D.
Department of Neurosurgery,
Kobe City General Hospital
4-6, Minatojima-Nakamachi,
Chuo-ku, Kobe, 650-0046, Japan
E-mail: sara20021209@yahoo.co.jp